US009069394B2

(12) **United States Patent**
Clayton et al.

(10) **Patent No.:** **US 9,069,394 B2**
(45) **Date of Patent:** **Jun. 30, 2015**

(54) **FULLY CLICKABLE TRACKPAD**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 247 days.

(21) Appl. No.: **13/424,817**

(22) Filed: **Mar. 20, 2012**

(65) **Prior Publication Data**

US 2014/0139442 A1 May 22, 2014

(51) **Int. Cl.**
  G06F 3/033 (2013.01)
  G06F 3/0354 (2013.01)
(52) **U.S. Cl.**
  CPC *G06F 3/03547* (2013.01)
(58) **Field of Classification Search**
  CPC ... G06F 3/03547; G06F 3/041; G06F 3/0488; G06F 2203/04105; G06F 3/0202; G06F 3/0213; G06F 2203/04101; H04M 2250/22; H04M 1/23; H01H 2003/0293
  USPC 345/156, 157, 173, 174; 178/18.01–18.11; 361/679.01, 679.02, 361/679.1
  See application file for complete search history.

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(57) **ABSTRACT**

According to one general aspect, an apparatus includes a trackpad that includes a cover member having a top surface and a switch coupled to the cover member. At least two spring members are coupled to the trackpad and are each disposed at a non-zero distance from each other and are each configured to collectively bias the trackpad in a first position in which the top surface of the cover member is in a first plane. The trackpad is movable to a second position in which the top surface of the cover member is in a second plane substantially parallel to the first plane when an input force is exerted on the top surface of the cover member. The switch is configured to trigger an electrical signal within a computer when the trackpad is moved to its second position.

19 Claims, 15 Drawing Sheets

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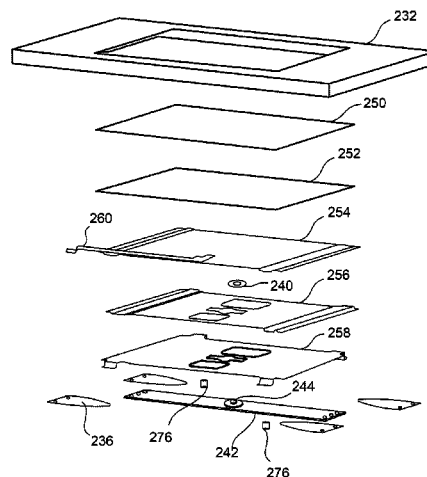
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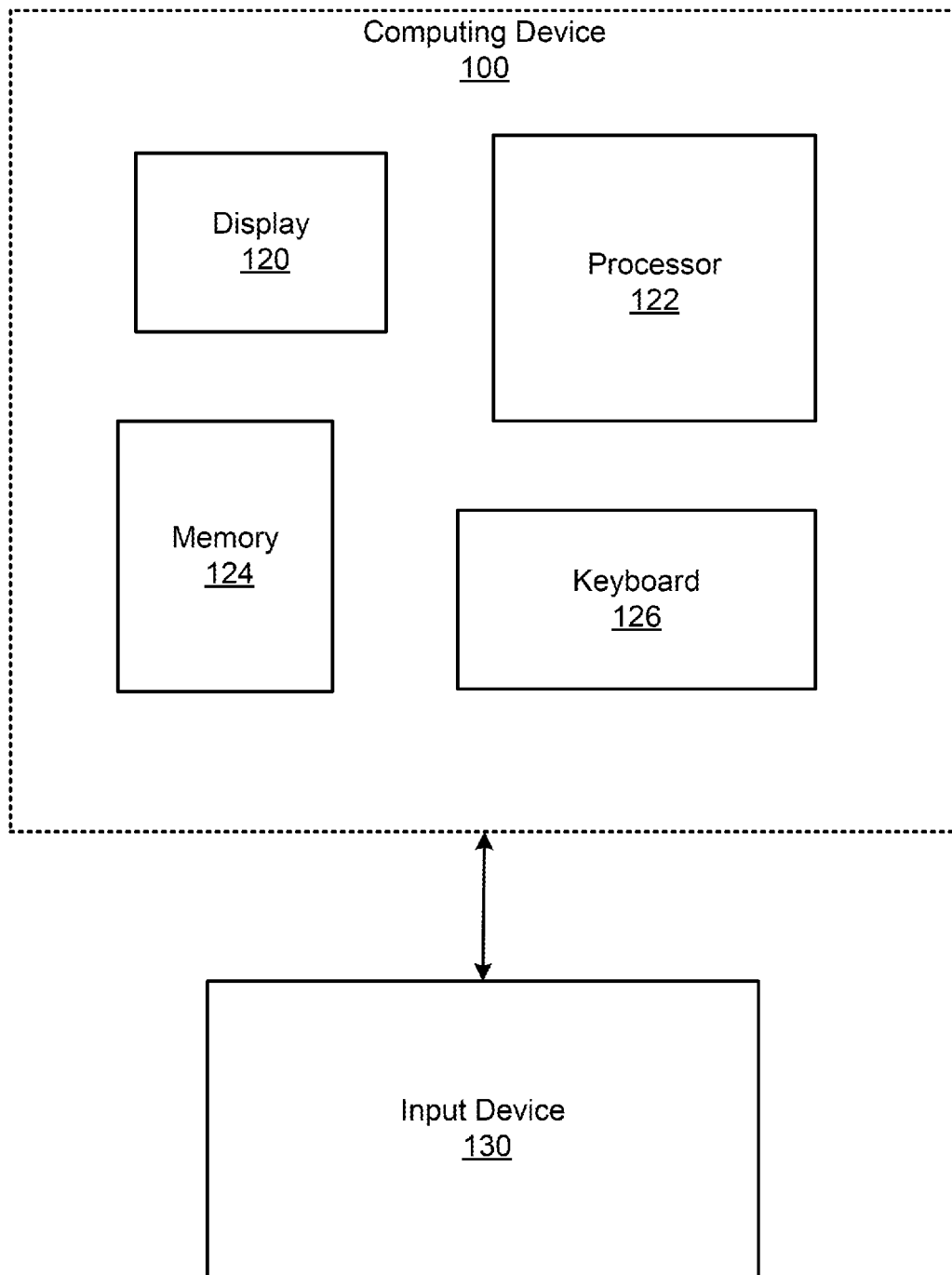* cited by examiner
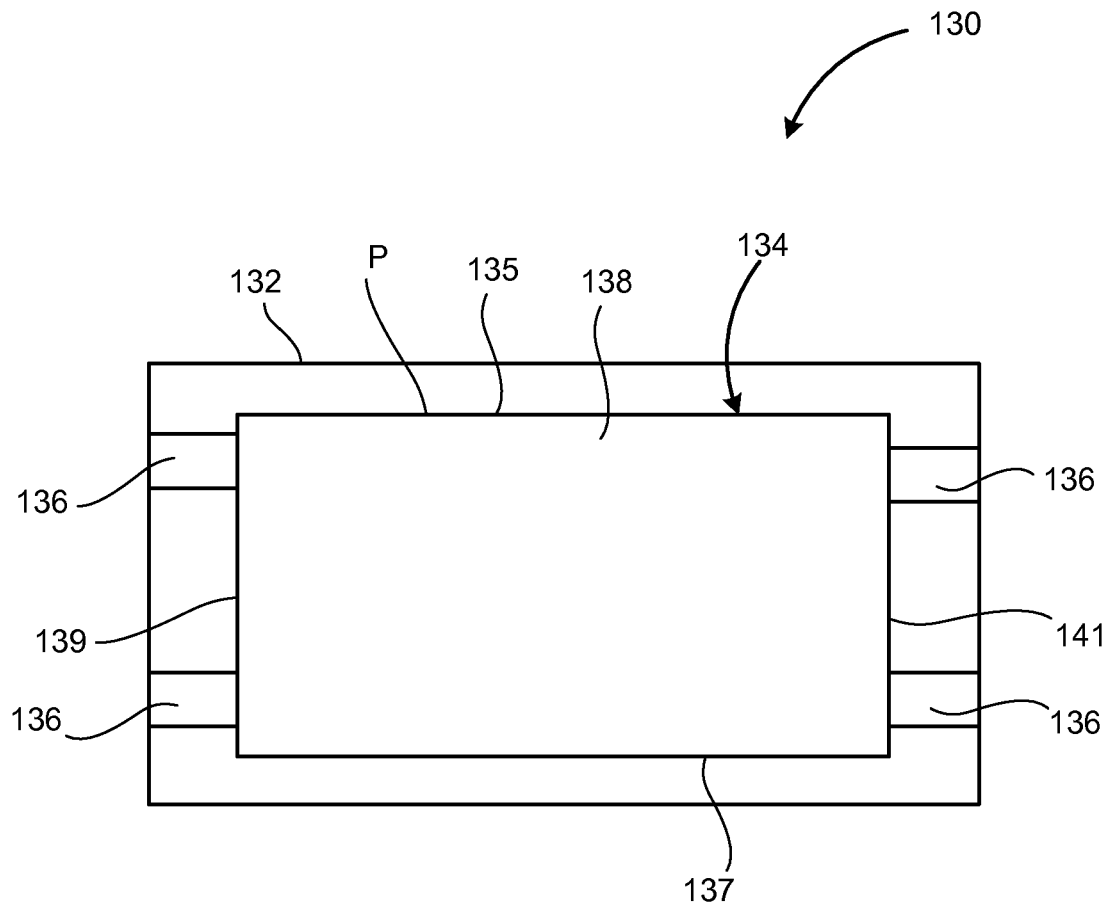
Computing Device
100

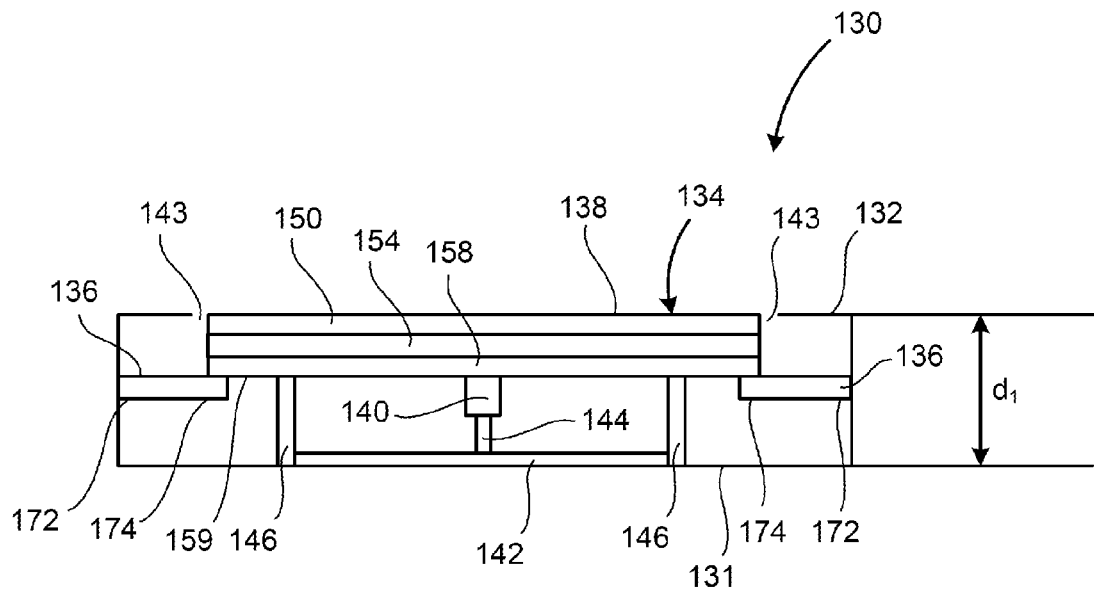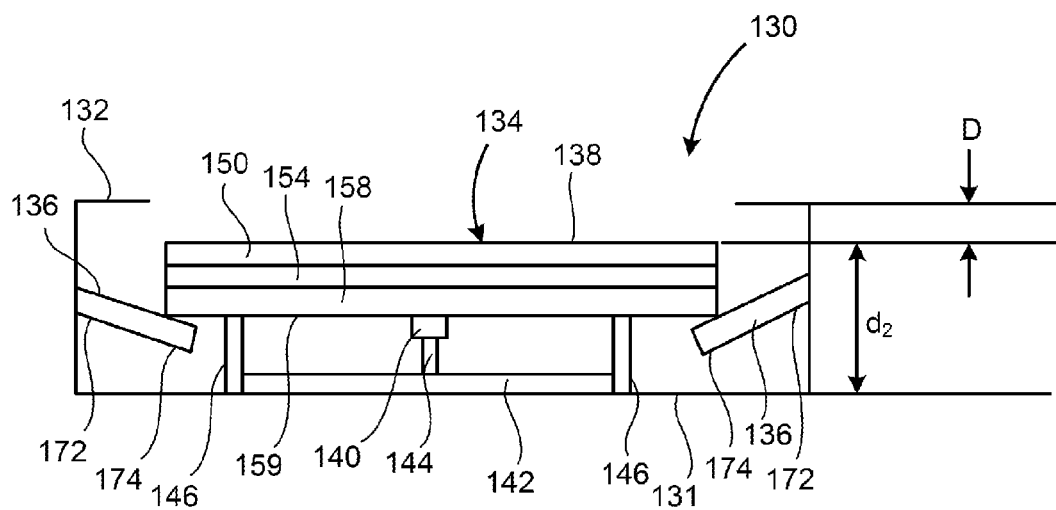Display
120

Processor
122

Memory
124

Keyboard
126

Input Device
130

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

250

252

254

260

230

240

265   263   256

267

264   258

270   268   266   246   270

270
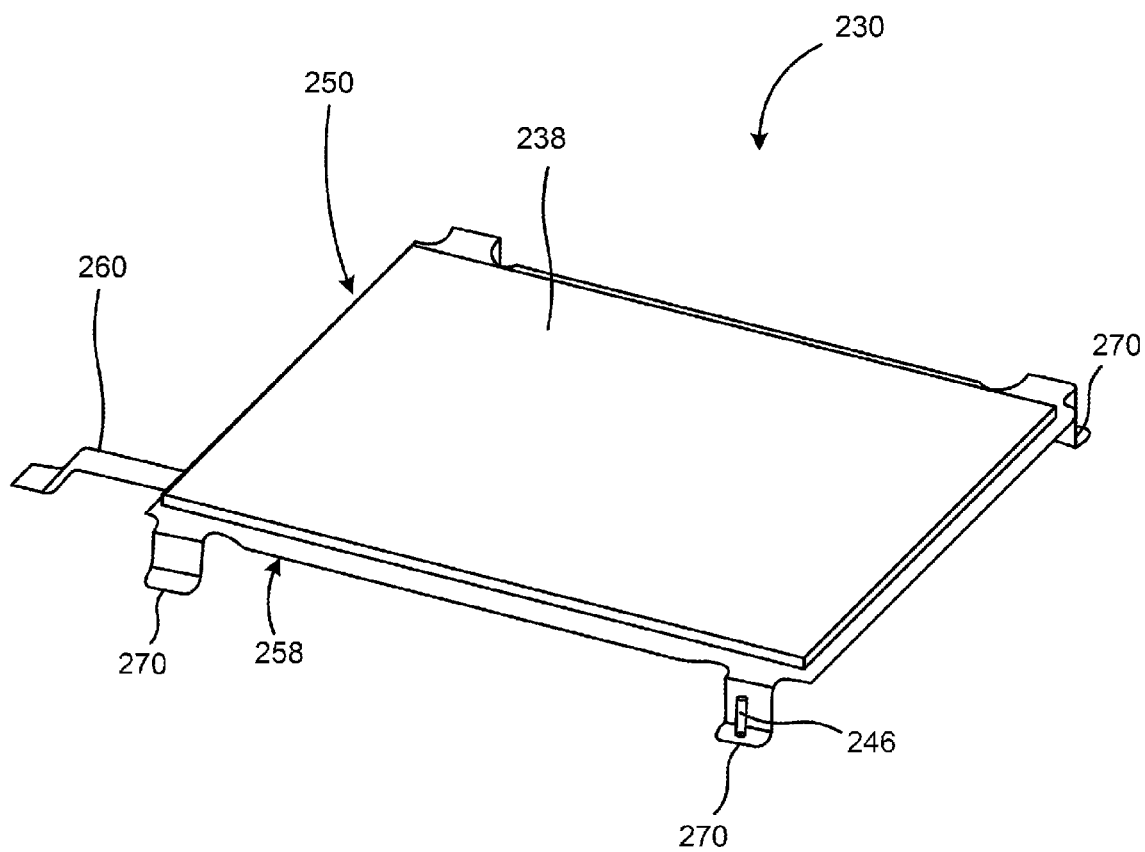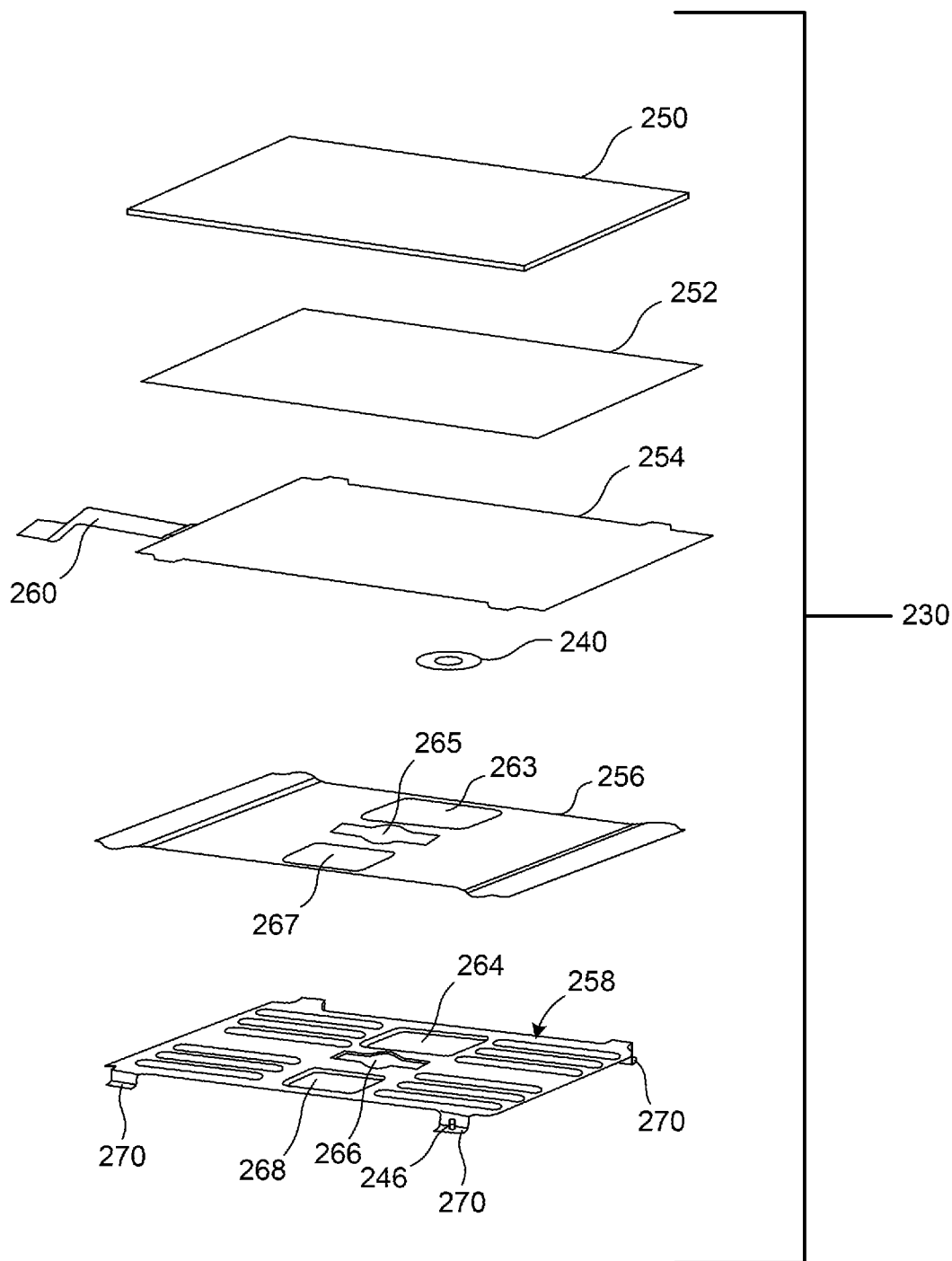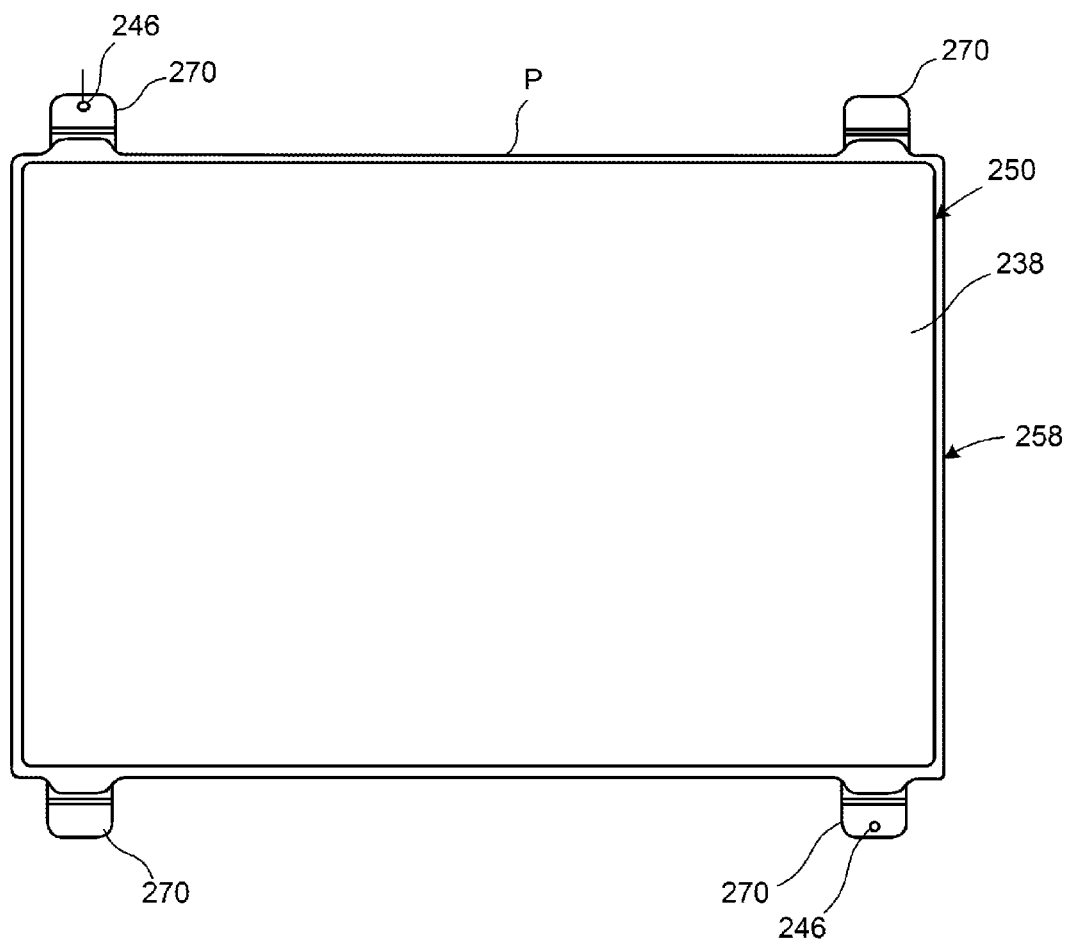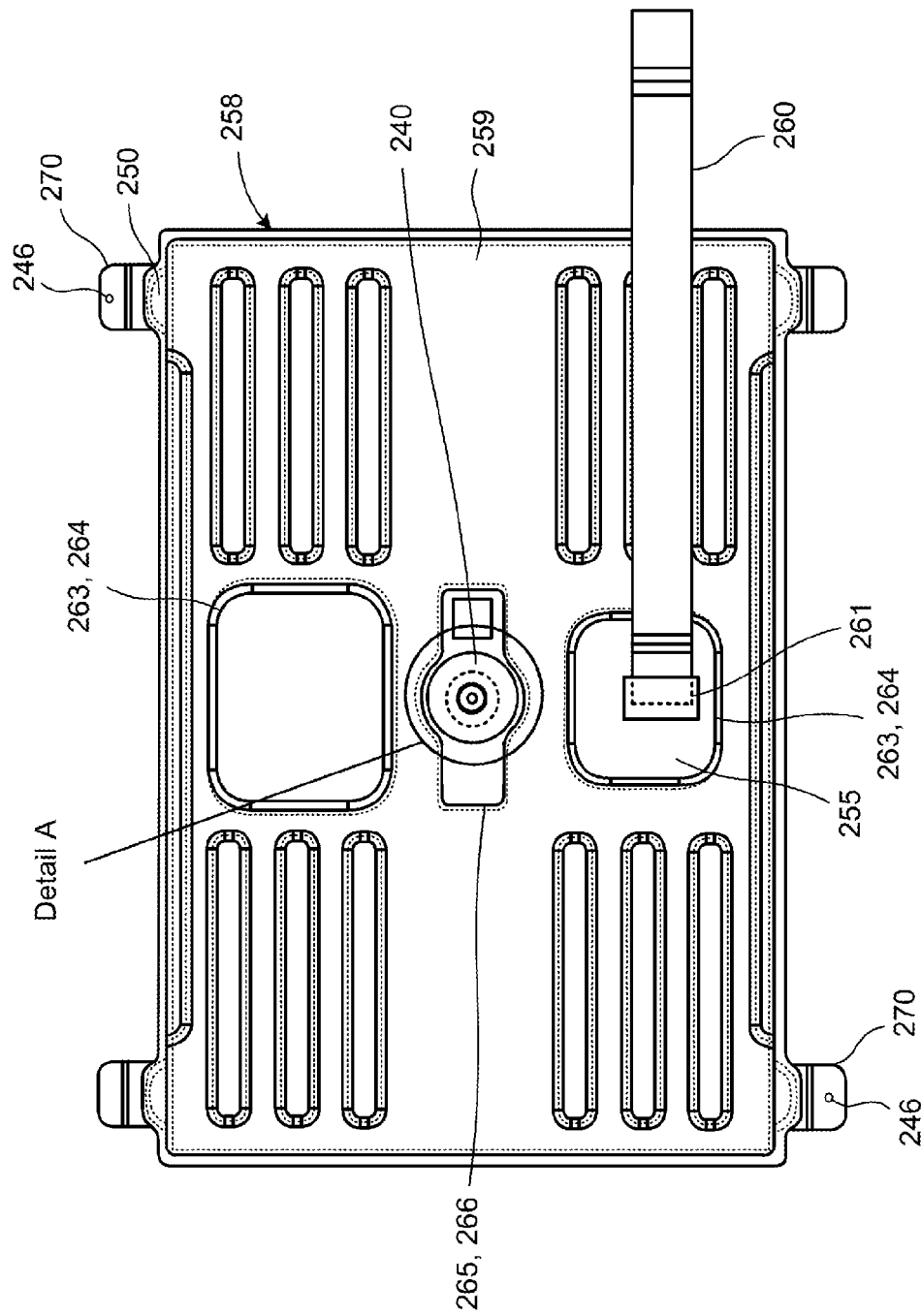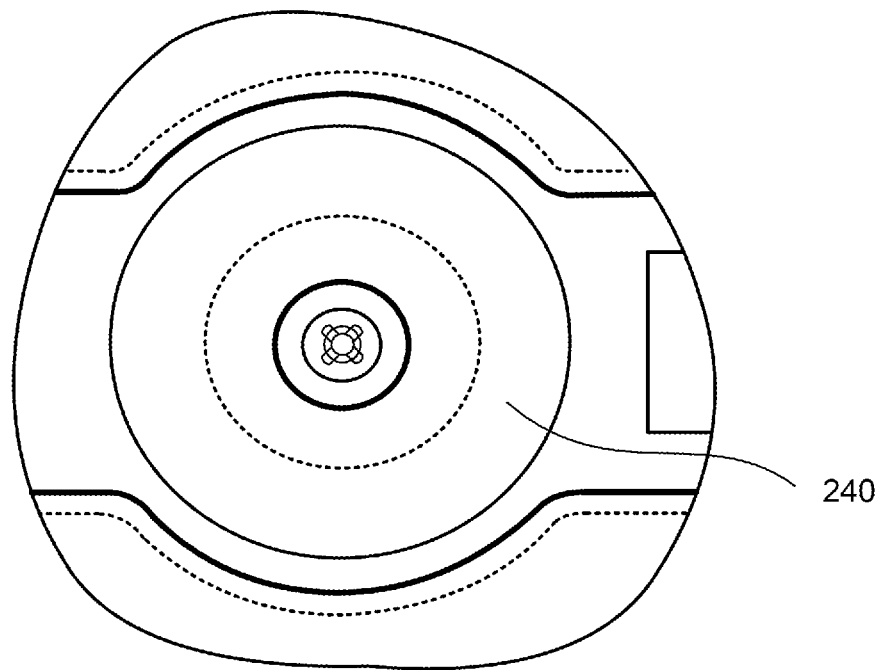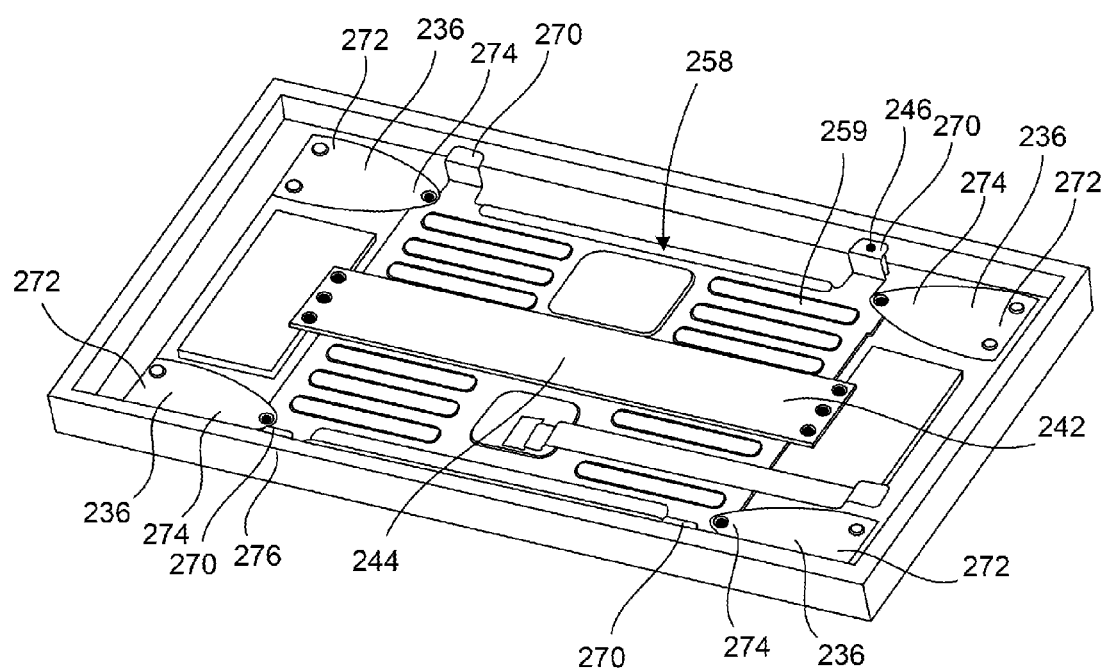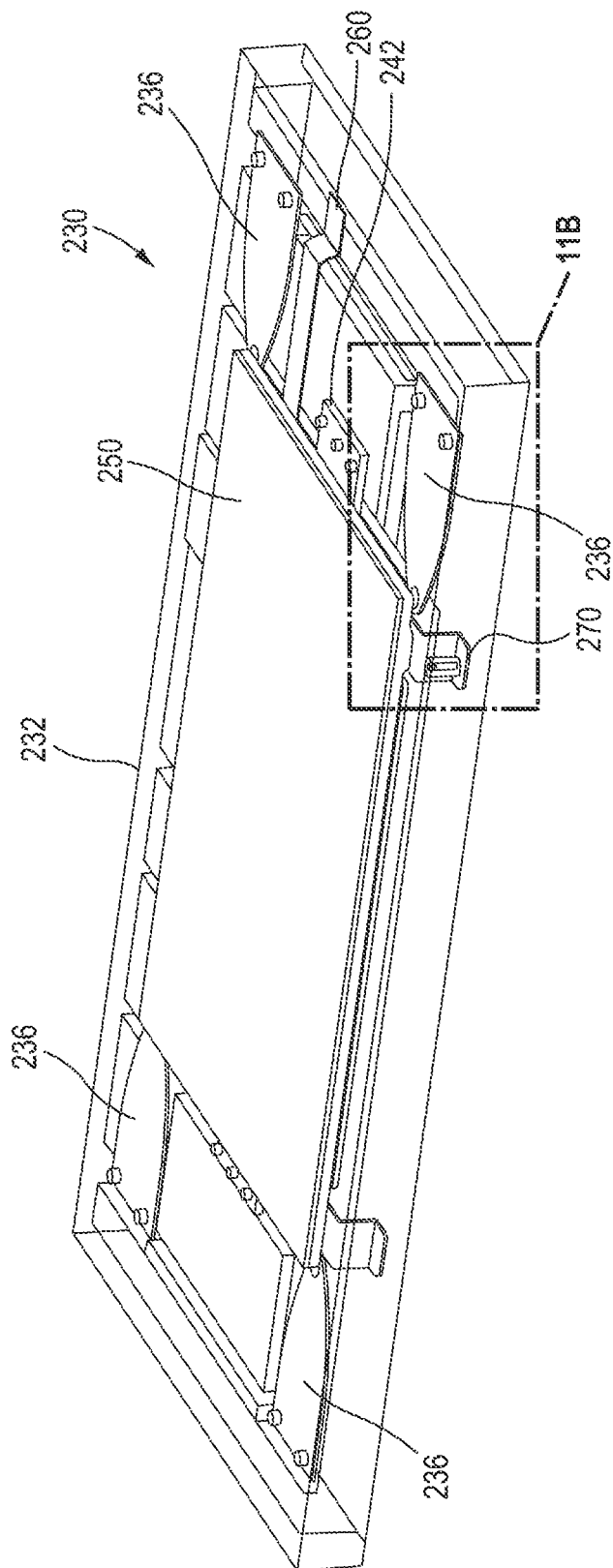
FIG. 7

FIG. 8

FIG. 9A

240
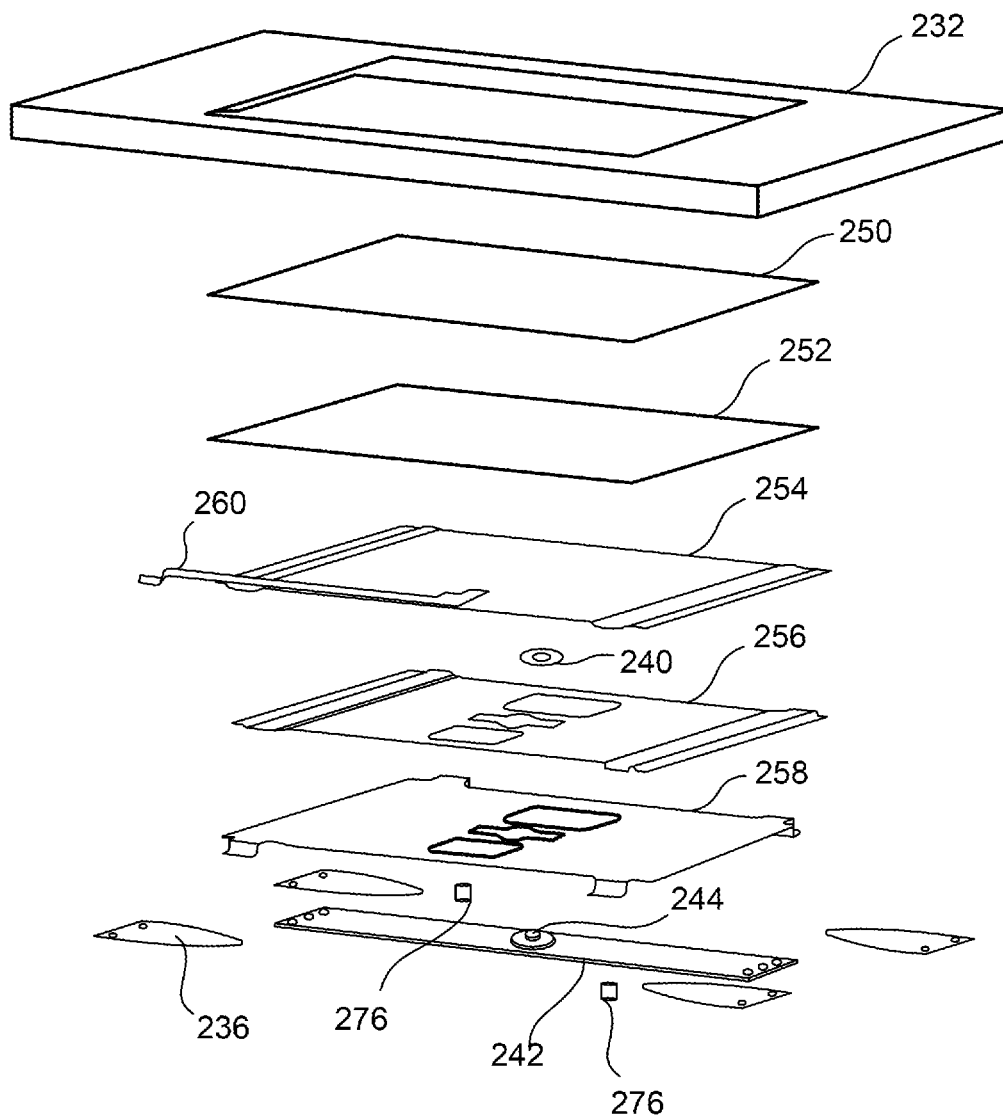
FIG. 9B

FIG. 10

FIG. 11A

FIG. 11B

FIG. 12

FIG. 13

300

302

320

338

332

304

380

350

330
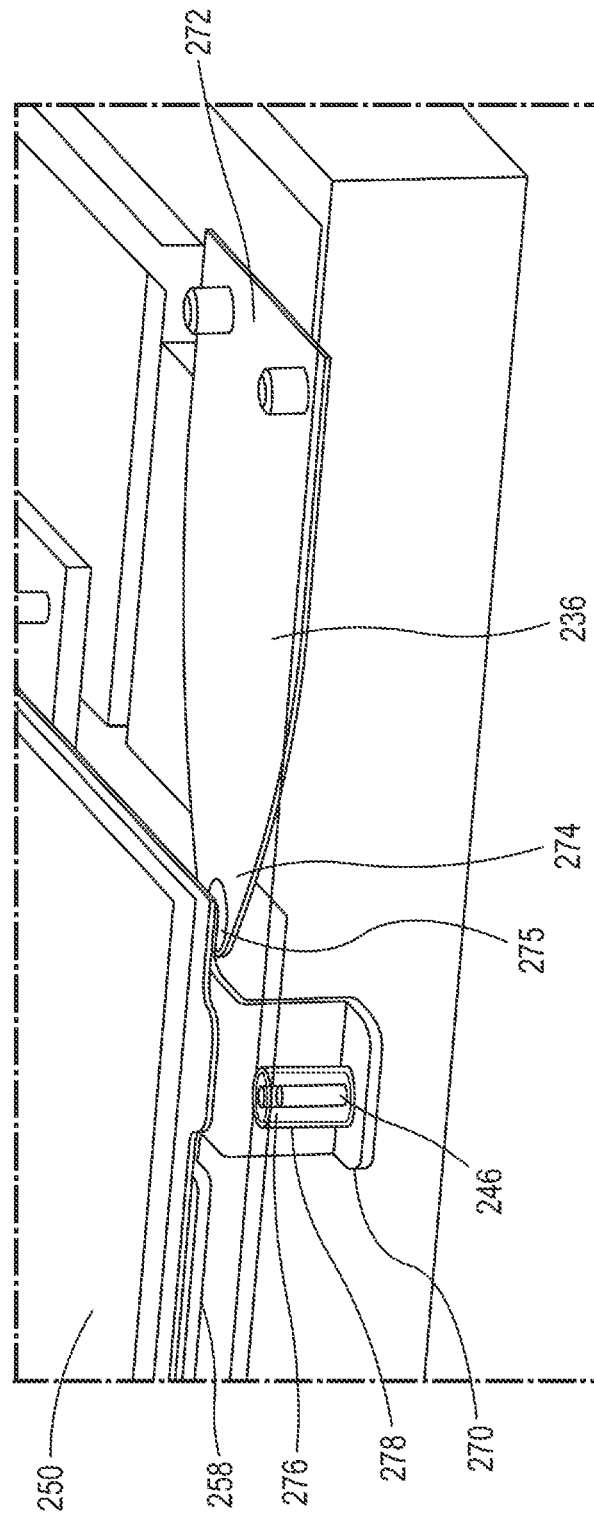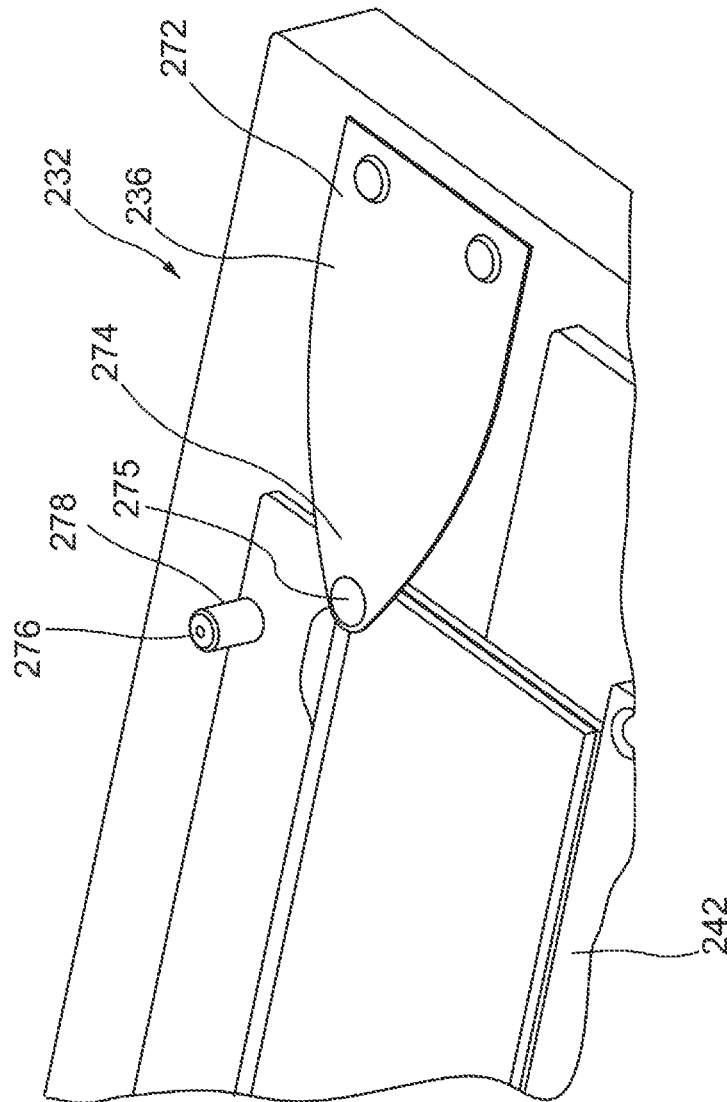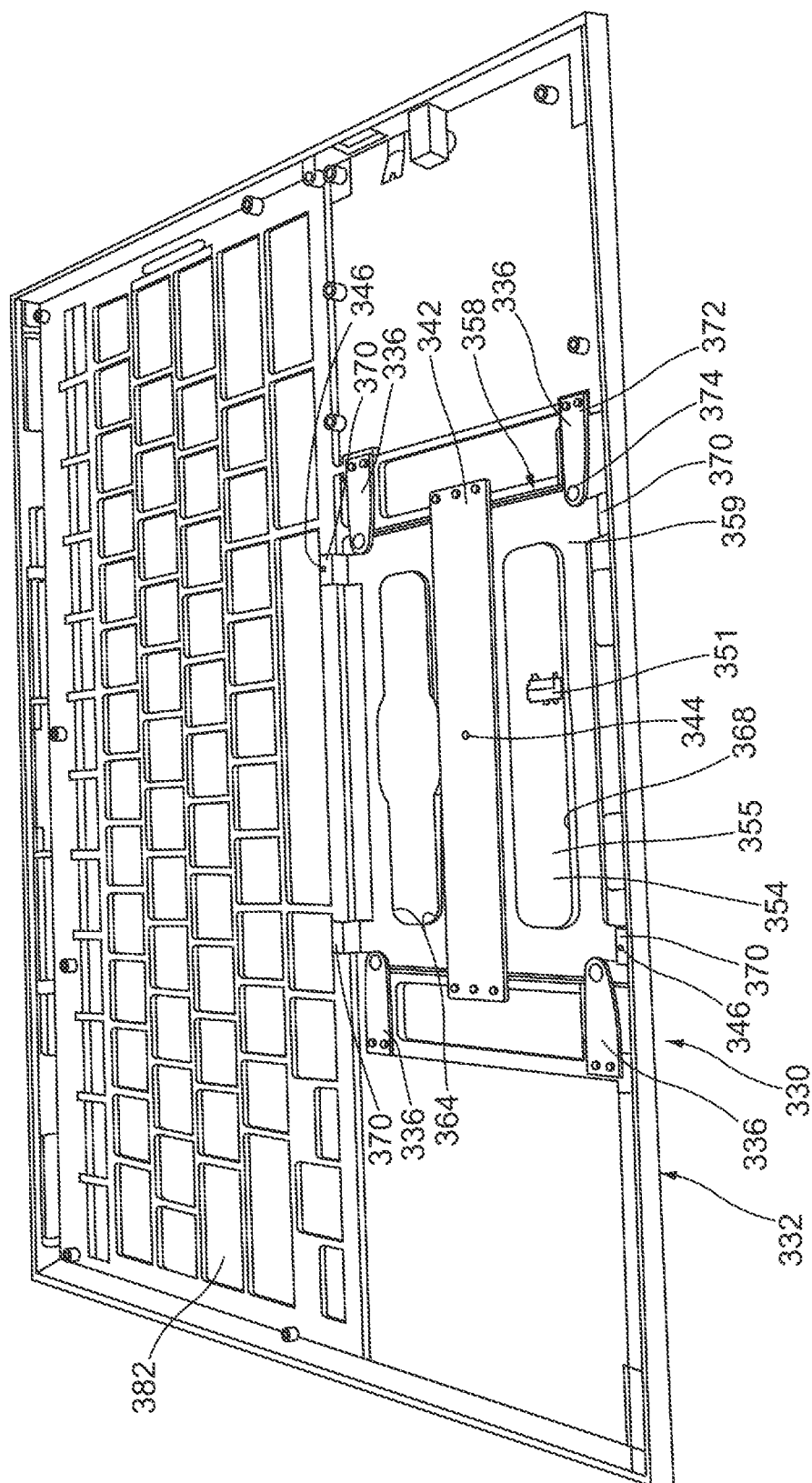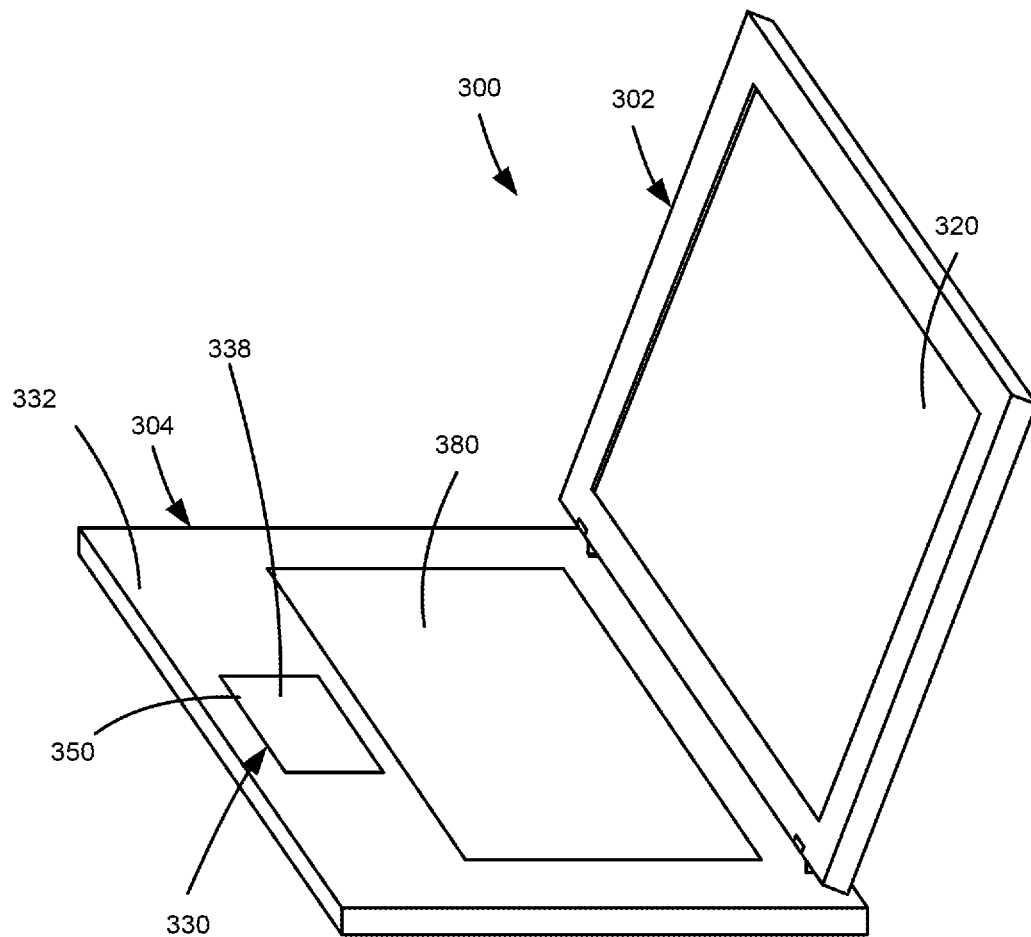
FIG. 14

FULLY CLICKABLE TRACKPAD

TECHNICAL FIELD

This description relates to an input device for use with a computing device, such as, a trackpad or a touchpad.

BACKGROUND

Some computing devices, such as, for example, laptop computers, include one or more input devices, such as, for example, a mouse, a keyboard, or a touchscreen. Some computing devices include a trackpad or touchpad that can be used in place of or in addition to a mouse to maneuver a curser on a computer screen, or to trigger one or more functions of a computing device. Such trackpads or touchpads can be coupled to, or integrated within, the computing device

There are a variety of different types of trackpads and touchpads that offer a variety of different gesture and/or sensor capabilities. Some trackpads and touchpads operate by the user moving or sliding one or more fingers across the surface of the trackpad or touchpad. Some trackpads or touchpads can respond to an action initiated by a stylus or other instrument that contacts the trackpad or touchpad. Some trackpads or touchpads can also include a "click" feature that allows the user to, for example, perform a right click function. In such devices, the trackpad or touchpad will typically have a specific or limited sensor location or area, referred to as a "sweet spot," on the surface of the trackpad or touchpad in which a user must contact to activate such a clicking function.

Thus, it is desirable to have a trackpad or touchpad that can be actuated at any location across the entire surface of the trackpad or touchpad to improve functionality and ease of use of the clicking function.

SUMMARY

According to one general aspect, an apparatus includes a trackpad that includes a cover member having a top surface and a switch coupled to the cover member. At least two spring members are coupled to the trackpad and are each disposed at a non-zero distance from each other and are each configured to collectively bias the trackpad in a first position in which the top surface of the cover member is in a first plane. The trackpad is movable to a second position in which the top surface of the cover member is in a second plane substantially parallel to the first plane when an input force is exerted on the top surface of the cover member. The switch is configured to trigger an electrical signal within a computer when the trackpad is moved to its second position.

According to another general aspect, an apparatus includes a housing and a trackpad coupled to the housing. The trackpad includes a cover member having a top surface configured to receive an input force and a switch coupled to the cover member. The top surface of the cover member has an outer perimeter. At least two support members each have a first end coupled to the housing and are disposed outside the outer perimeter of the top surface of the cover member and a second end contacting the trackpad. The second end of each of the at least two support members collectively configured to support the trackpad in a first position relative to the housing. The trackpad being movable to a second position relative to the housing when an input force is exerted on the top surface of the cover member. The switch configured to be actuated when the trackpad is moved to its second position.

According to another general aspect, an apparatus includes a housing and a trackpad coupled to the housing. The trackpad

includes a cover member having a top surface and switch coupled to the cover member. The track pad includes at least two pins slidably coupled to the housing to allow slidable movement of the trackpad relative the housing. At least two support members are coupled to the trackpad. The at least two support members are collectively configured to bias the trackpad in a first position in which the top surface of the cover member is disposed in a first plane. The trackpad being slidably movable in a substantially vertical direction relative to the housing to a second position in which the top surface of the cover member is disposed in a second plane substantially parallel to the first plane when an input force is exerted on the top surface of the trackpad. The switch configured to trigger an electrical signal within a computer when the trackpad is moved to its second position.

The details of one or more implementations are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a computing device including an input device, according to an implementation.

FIG. 2 is a schematic illustration of a top view of an input device, according to an implementation.

FIG. 3 is a schematic illustration of a side view of the input device of FIG. 2, shown with at trackpad in a first position.

FIG. 4 is a schematic illustration of a side view of the input device of FIG. 2 shown with the trackpad in a second position.

FIG. 5 is an exploded view of an input device according to another implementation.

FIG. 6 is a perspective view of a trackpad assembly, according to an implementation.

FIG. 7 is an exploded view of the trackpad assembly of FIG. 6.

FIG. 8 is a top view of a portion of the trackpad assembly of FIG. 6.

FIG. 9A is a bottom view of the trackpad assembly of FIG. 6.

FIG. 9B is an enlarged view showing detail A in FIG. 9A.

FIG. 10 is a bottom perspective view of the input device of FIG. 5.

FIG. 11A is a top perspective view of the input device of FIG. 5.

FIG. 11B is an enlarged view showing detail B in FIG. 11A.

FIG. 12 is an enlarged bottom perspective view of a portion of the input device of FIG. 5, with the trackpad assembly removed.

FIG. 13 is a bottom perspective view of an input device according to another implementation.

FIG. 14 is a perspective view of a computing device incorporating an input device according to an implementation.

DETAILED DESCRIPTION

An input device for use with a computing device is described herein that can be used to communicate with and control operations of a computing device. The input devices can be configured to be contacted by a user on a top surface of the input device to trigger an electronic signal within the computing device. For example, a user can slide or move one or more fingers, or a portion of a hand, across the top surface of the input device to move a curser visible on a display of the computing device. The input devices can also include a "click" function to allow the user to for example, click or select items on the display, or to actuate a right click function.

The input devices described herein can allow a user to actuate a click function by exerting or applying a force on a top surface of the input device at any location on the top surface. In other words, the input device does not have a specific sensor location that the user must find to actuate a click function. The input device can also travel a consistent vertical distance and provide a consistent tactile response to the user when the user clicks on any portion of the top surface of the input device.

As used herein, a reference to a top view in a figure refers to a view as viewed by a user during use of an input device. For example, a top view can refer to a view of the input device as disposed within a computing device such that the user can contact the top surface of the input device to initiate an action within the computing device. A reference to a bottom view of the input device refers to a view from underneath or below the input device and that is typically not viewable by a user during use of the input device.

FIG. **1** is a block diagram of a computing device **100** that can be used in conjunction with an implementation of an input device **130**. The input device **130** can be used by a user of the computing device **100** to communicate with, control, and/or actuate one or more functions on the computing device **100**. For example, the input device **130** can be used to move a curser on a display screen of the computing device **100**. The input device **130** can be for example a trackpad or touchpad as described in more detail below. The input device **130** can be, for example, a touch (e.g., contact) sensitive device, such as, for example, an electrostatic device, a resistive device, a surface acoustic wave (SAW) device, a capacitive device, a pressure sensitive device, a surface capacitive device, a projected capacitive touch (PCT) device, and/or so forth. The input device **130** can be integrated with the computing device **100** or couplable to the computing device **100**. The input device **130** can have a wired connection to the computing device **100** or a wireless connection (e.g., wi-fi enabled).

The computing device **100** can include, for example, a display **120**, one or more processors **122**, one or more memory components **124**, and/or a keyboard **126** and/or other touchscreen (not shown). The computing device **100** can be, for example, a wired device and/or a wireless device (e.g., wi-fi enabled device). The computing device **100** can be, for example, a computing entity (e.g., a personal computing device, such as, a laptop computer, a desktop computer, a netbook computer, a tablet, a touchpad, etc.), a server device (e.g., a web server), a mobile phone, a personal digital assistant (PDA), e-reader, and/or so forth. The computing device **100** can be configured to operate based on one or more platforms (e.g., one or more similar or different platforms) that can include one or more types of hardware, software, firmware, operating systems, runtime libraries, and/or so forth.

In some implementations, the computing device **100** can represent a cluster of devices. In such an implementation, the functionality and processing of the computing device **100** (e.g., the one or more processors **122** of the computing device **100**) can be distributed to several computing devices of the cluster of computing devices.

In some implementations, one or more portions of the components of computing device **100** can be, or can include, a hardware-based module (e.g., a digital signal processor (DSP), a field programmable gate array (FPGA), a memory), a firmware module, and/or a software-based module (e.g., a module of computer code, a set of computer-readable instructions that can be executed at a computer). In some implementations, the functionality of the components can be included in different modules and/or components not shown in FIG. **1**. The components of the computing device **100** can be config-

ured to operate within an environment that includes an operating system. In some implementations, the operating system can be configured to facilitate, for example, the interpretation of an interaction with the input device **130**.

In some implementations, the computing device **100** can be included in a network. In some implementations, the network can include multiple computing devices (such as computing device **100**) and/or multiple server devices (not shown). Also, although not shown in FIG. **1**, the computing device **100** can be configured to function within various types of network environments. For example, the network can be, or can include, a local area network (LAN), a wide area network (WAN), and/or so forth. The network can be, or can include, a wireless network and/or wireless network implemented using, for example, gateway devices, bridges, switches, and/or so forth. The network can include one or more segments and/or can be have portions based on various protocols such as Internet Protocol (IP) and/or a proprietary protocol. The network can include at least a portion of the Internet.

The display **120** of the computing device **100** can be, for example, a liquid crystal display (LCD), a liquid emitting diode (LED) display, or other type of display device. The one or more memory component **124** can be any type of memory device such as a random-access memory (RAM) component or a disk drive memory. As shown in FIG. **1**, a memory component **124** can be a local memory included in the computing device **100**. Although not shown, in some implementations, the memory component(s) **124** can be implemented as more than one memory component **124** (e.g., more than one RAM component or disk drive memory) within the computing device **100**. In some implementations, the memory component(s) **124** can be, or can include, a non-local memory (e.g., a memory not physically included within the computing device **100**) within a network (not shown). For example, the memory component(s) **124** can be, or can include, a memory shared by multiple computing devices (not shown) within a network. In some implementations, the memory component(s) **124** can be associated with a server device (not shown) on a client side of a network and configured to serve several computing devices on the client side of the network.

The input device **130** can be configured to be contacted by a user on a top surface of the input device **130** to trigger an electronic signal within the computing device **100**. For example, a user can slide or move one or more fingers, or a portion of a hand, across the top surface of the input device **130** to move a curser visible on the display **120**. The input device **130** can also include a "click" function to allow the user to click or select items on the display **120** or to actuate a function to be performed by the computing device **100**. In one example, the input device **130** can be used to perform a "right click" function to bring up a drop-down menu on the display **120**. The input device **130** is configured to allow the user to click on any portion of the top surface of the input device **130**. Thus, the user can receive a consistent tactile response when clicking on any portion of the top surface of the input device **130**. Such functionality can provide an easier and more efficient computing experience for the user.

As shown schematically in FIGS. **2-4**, the input device **130** can include an enclosure or housing **132**, a trackpad assembly **134** (also referred to as "trackpad"), and one or more support members **136**. In some implementations, the housing **132** of the input device **130** can be a housing of the computing device **100**. In other words, in such an implementation the enclosure or housing of the input device **130** is integral with the housing of the computing device **100**. In some implementations, the housing **132** of the input device **130** can be a separate housing component. For example, in some such implementations, the

input device **130** can be couplable to the computing device **100**. In some implementations, the input device **130** is physically coupled to the computing device **100** and in some implementations the input device **130** is not physically coupled to the computing device **100**. For example, the input device **130** may communicate with the computing device **100** with a wireless connection.

The trackpad **134** can include a cover member **150**, a sensor **154** and a base member **158**. The cover member **154** can include a top surface **138** configured to be contacted by a user to actuate and trigger an electrical response within the computing device **100**. For example, the sensor **154** can be activated when a user enters an input (e.g., a touch or a click) on the top surface **138** of the cover member **150**. The sensor **154** can be, for example, a flame-retardant class-4 (FR4) printed circuit board. The trackpad **134** can also include a switch **140** that can be used to trigger a response to a click function input by a user. For example, the switch **140** can be electrically coupled to the sensor **154** such that when a user applies or exerts an input force on the top surface **138** of the cover member **150**, the switch **140** can be actuated and communicate an electronic signal to the sensor **154**. The switch **140** can be, for example, a dome switch. The switch **140** can include electronic components commonly used in such switches such that the switch **140** can electrically communicate with the sensor **154**. The switch **140** can be formed at least in part, with, for example, a metallic material, such as a stainless steel (e.g., SUS301) and can include a flexible portion that can be flexed or compressed when an actuated. For example, the switch **140** can be pressed against an actuation member **144** of the input device **130** when the trackpad **134** is actuated as described in more detail below. The actuation member **144** can be, for example a set screw. The actuation member **144** can be threadably coupled to an arm member **142** that is coupled to the housing **132**.

The one or more support members **136** can be coupled to the housing **132** and can be configured to bias the trackpad **134** into a first position relative to the housing **132**, as shown in FIG. **3**. The support members **136** can include a first end portion **172** that is fixedly coupled to the housing **132** with, for example, screws or other suitable fasteners, and a second end portion **174** (see FIGS. **3** and **4**) that is disposed below the trackpad **134** and contacts a bottom surface **159** of the trackpad **134**. The second end portion **174** can be, for example, cantilevered from the first end portion **172** such that it is "free-floating." As shown in FIG. **2**, the cover member **150** has a first side edge **135**, a second side edge **137** opposite the first side edge **135**, and a third side edge **139** opposite a fourth side edge **141**. The side edges **135**, **137**, **139**, **141** define an outer perimeter portion P of the cover member **150**. In some implementations, the first end portion **172** of the support members **136** can be coupled to the housing **132** at a location outside of the perimeter portion P (see FIGS. **2-4**)

The trackpad **134** can be moved to a second position, as shown in FIG. **4**, when a user exerts an input force on the top surface **138** to initiate a clicking function. The support members **136** can have a first configuration in which they are configured to support and maintain (e.g., bias) the trackpad **134** in its first position relative to housing **132**. The support members **136** can be configured to bend or flex such that when the trackpad **134** is moved to its second position as mentioned above, the trackpad **134** will exert a force on the second end portion of the support members **136** and move (e.g., bend or flex) the support members **136** to a second configuration. In other words, the second end portion of the support members **136** can bend or flex relative to the first end portion of the support members **136**. The support members **136** can be, for

example, spring members. For example, the support members **136** can be flat springs. In some implementations, the input device **130** can include, for example, two, three, four or more support members **136**. In some embodiments, the support members **136** can be on any side (side, top, and/or bottom) of the trackpad **134**, can be at different (e.g., opposite) corners of the trackpad **134**, can be on opposite sides of the trackpad **134**, can be paired and directly across from one another (as shown in FIG. **2**), can be at staggered positions on opposite sides (side, top, and/or bottom) of the trackpad **134**, and so forth.

The trackpad **134** can move from its first position to its second position by slidably moving relative to the housing **132** in a substantially vertical direction such that the top surface **138** of the support member **150** is moved from a first plane to a second plane that is substantially parallel to the first plane. In other words, the entire top surface **138** is moved vertically a distance D (see FIG. **4**) when the trackpad **134** is moved from its first position to its second position. In some embodiments, the distance D can be between 0.15 to 0.25 millimeters (mm) (e.g., 0.22 mm, 0.2 mm). In some embodiments, the distance D can be greater than 0.25 mm (e.g., 0.3 mm, 0.4 mm) or less than 0.15 mm (e.g., 0.1 mm). In some embodiments, the variation in distance D across the trackpad **134** can be approximately ±20%. In some embodiments, the variation in distance D across the trackpad **134** can be greater than 20% (e.g., 25%, 30%), or less than 20% (e.g., 10%, 5%). Said another way, the top surface **138** is disposed at a distance d_1 relative to a bottom wall **131** of the housing **132**, as shown in FIG. **3**, and is moved to a distance d_2 relative to the bottom wall of the housing **132**, as shown in FIG. **4**. Thus, the outer perimeter portion P of the cover member **150** is moved substantially an equal distance when the trackpad **134** is moved from its first position to its second position.

In some implementations, the trackpad **134** can be slidably coupled to the housing **132** with one or more alignment pins **146** that can be slidably received within a corresponding opening(s) defined in the housing **132**. In some implementations, the one or more alignment pins can be slidably received within a corresponding bushing(s) (not shown in FIGS. **1-4**) coupled to the housing **132**. The bushings can be, for example, Delrin bushings. In some implementations, the touchpad **134** includes two alignment pins. The alignment pins **146** can also be used to help align the trackpad **134** to the housing **132**. For example, such alignment can be useful to maintain a desired tolerance of a gap **143** defined between the outer perimeter portion P of the cover member **150** and the housing **132** as shown in FIG. **3**.

The slidable coupling of the trackpad **134** to the housing **132** together with the support members **136** allows the trackpad **134** to be actuated with a clicking function when a user exerts an input force on any portion of the top surface **138** of the cover member **150**. Thus, the user does not have to search for a specific "sensor location" or "sweet spot" on the trackpad **134** to actuate a clicking function.

FIGS. **5-12** illustrate an implementation of an input device **230**. The input device **230** includes a housing **232**, a trackpad assembly **234** and support members **236**. In this implementation, the housing **232** can be coupled to a computing device (e.g., computing device **100** described above) or can be used as a separate component that communicates with the computing device **100** using a wireless connection. The input device **230** can be, for example, a touch (e.g., contact) sensitive device, such as, for example, an electrostatic device, a resistive device, a surface acoustic wave (SAW) device, a capaci-

tive device, a pressure sensitive device, a surface capacitive device, a projected capacitive touch (PCT) device, and/or so forth.

FIG. 6 is a perspective view of the trackpad assembly 234 and FIG. 7 is an exploded view of the trackpad assembly 234 (also referred to as "trackpad"). As shown in FIG. 7, the trackpad 234 includes a cover member 250, a first adhesive sheet 252, a sensor (e.g., a printed circuit board) 254, a dome switch 240, a second adhesive sheet 256 and a base member 258. The cover member 250 can be formed with, for example, an electrostatic glass material. The cover member 250 has a top surface 238, which is the top surface of the trackpad 234 and is configured to receive inputs (e.g., a touch or click) by a user. The sensor 254 can be activated, for example, when a user touches or applies a force on the top surface 238 of the cover member 250, and can communicate electronic signals within the computing device 100. The sensor 254 can be, for example, a flame-retardant class-4 (FR4) printed circuit board.

The first adhesive sheet 252 can be adhered to a bottom surface (not shown) of the cover member 250 and used to adhesively couple the sensor 254 thereto. The first adhesive layer can be, for example, a pressure sensitive adhesive (PSA). A cable 260 can be coupled to the sensor 254. The cable 260 can be, for example, a flat flex cable (FFC) or a flexible printed circuit (FPC). For example, the cable 260 can be coupled to a connector 261 disposed on a bottom surface 255 of the sensor 254, as shown in FIG. 9A. The connector 261 can be, for example, a zero insertion force (ZIF) connector. An end of the cable 260 can be inserted into the connector 261 with contacts (not shown) of the cable 260 facing down, as shown in FIG. 9A.

The second adhesive sheet 256 can be adhered to a top surface 262 of the base member 258 such that the openings 263, 265, and 267 defined in the adhesive sheet 256 align with corresponding openings 264, 266 and 268 defined in the base member 258. As with the first adhesive sheet 252, the second adhesive sheet 256 can be, for example, a pressure sensitive adhesive (PSA). The second adhesive sheet 256 can be used to couple the base member 258 to the bottom surface 255 of the sensor 254. The dome switch 240 can also be adhesively coupled to the bottom surface 255 of the sensor 254 such that the dome switch 240 can extend through the opening 265 of the second adhesive sheet 256 and the opening 266 in the base member 258, as best shown in the bottom views of FIGS. 9A and 9B. Also shown in FIG. 9A, when the trackpad 234 is assembled, a portion of the cable 260 can extend through the openings 263 and 264.

The base member 258 includes four legs 270 that can be used to support and couple the trackpad 234 to the housing 232. Although four legs 270 are shown, it should be understood that a different number of legs can alternatively be used. In addition, in alternative implementations, the legs 270 can be disposed at different locations on the base member 258. The base member 258 also includes two alignment pins 246 disposed on or coupled to two of the legs 270. In this implementation, the alignment pins 246 are disposed on legs 270 on opposite corners of the base member 258. As described above and as described in more detail below, the alignment pins 246 can be used to align and slidably couple the trackpad 234 to the housing 232. Although two alignment pins 246 are shown, it should be understood that a different number of alignment pins 246 can alternatively be included. For example, in an alternative implementation, the base member 258 can include three legs 270 and each can include an alignment pin 246. The three legs 270 can be located along the perimeter of the base member 258 in a spaced relationship to each other such that

the legs 270 can consistently support the base member 258 during actuation of the input device 230.

The dome switch 240 can be electrically coupled to the sensor 254 such that when the dome switch 240 is actuated, the dome switch 240 can communicate an electronic signal to the sensor 254. The dome switch 240 can include electronic components commonly used in such switches that can electrically communicate with the sensor 254. The dome switch 240 can include a flexible or compressible portion that can be flexed or compressed when actuated. For example, the dome switch 240 can be pressed against an actuation member 244 (described below) when a user applies an input force on the top surface 238 of the cover member 250 to initiate a click function.

As shown, for example, in FIGS. 5 and 10, the input device 230 also includes an arm member 242 that can be coupled to the housing 232 and the actuation member 244 can be coupled to the arm member 242. In this implementation, the actuation member 244 is a set screw. As described above for input device 130, during actuation of the input device 230 (e.g., a clicking function), the dome switch 240 can be compressed against the actuation member 244 to trigger an electronic signal within a computing device (e.g., computing device 100) (e.g., via the sensor 254). A height of the actuation member 244 can be adjusted by threadably turning the actuation member 244 (e.g., set screw) until a head of the actuation member 244 (e.g., a head of the set screw on which the dome switch 240 is compressed during actuation) is at a desired height or location relative to the housing 232 and/or the dome switch 240.

The input device 230 includes four support members 236 configured to support the trackpad 234 in a first position relative to the housing 232. The support members 236 can be, for example, spring members. The support members 236 can be, for example, flat springs. The support members 236 can be formed with for example, a stainless steel material such as SUS 301. Although four support members 236 are included in this implementation, it should be understood that a different number of support members can alternatively be used. For example, three support members or less can be used. In some implementations, more than four support members 236 can be used.

As shown, for example, in FIGS. 10, 11A and 11B (which illustrate the assembled input device 230), the support members 236 include a first end portion 272 fixedly coupled to the housing 232 and a second end portion 274 that is free-floating and disposed beneath and contacting a bottom surface 259 of the base member 258 of the trackpad 234. As described above, the second end portion 274 is free-floating in that it is cantilevered from the first end portion 272. The second end portion 274 can also include a bump or raised portion 275 on which the base member 258 can rest. The first end portion 272 is disposed outside an outer perimeter portion P of the cover member 250 (see FIG. 8).

The support members 236 can have a first configuration in which the support members 236 bias and support the trackpad 234 in its first position and can be moved (e.g., bend or flex) to a second configuration when the trackpad 234 is moved to a second position relative to the housing 232. For example, when a user exerts an input force on the top surface 238 of the cover member 250 to initiate a clicking function, the trackpad 234 will be moved downward (e.g., in a vertical direction) to its second position and exert a force on the support members 236. In other words, the second end portion 274 of the support members 236 can bend or flex relative to the first end portion 272 of the support members 236 when a force exerted on the top surface 238 of the trackpad 234.

The trackpad **234** can be slidably coupled to the housing **232** with the alignment pins **246** on the base member **258**. As shown, for example, in FIG. **12**, bushings **276** can be disposed within channels **278** defined in the housing **232** (FIG. **12** illustrates an enlarged portion of the input device **230** with the trackpad **234** removed for illustration purposes). As shown, for example, in FIGS. **11A** and **11B** (the enclosure **232**, legs **270** and bushings **276** are shown transparent in FIGS. **11A** and **11B** for illustration purposes), the alignment pins **246** can be slidably received within the bushings **276**. In alternative implementations, the alignment pins **246** may be slidably received within a mating channel defined in the housing **232** (e.g., without the bushings **276**). The alignment pins **246** can provide a slidable coupling of the trackpad **234** to the housing **232** and can also help align the trackpad **234** to the housing **232** during assembly of the input device **230**. The alignment pins **246** can also provide for consistent vertical movement of the trackpad **234** when it is actuated (e.g., when a user exerts a force on the top surface of the trackpad) as described in more detail below.

The slidable coupling of the trackpad **234** to the housing **232** together with the support members **236** and the alignment pins **246** allows the trackpad **234** to move from its first position to its second position upon actuation by a user (e.g., an input force exerted on the top surface **238**) such that the top surface **238** of the cover member **250** is moved from a first plane to a second plane that is substantially parallel to the first plane. Said another way, the entire top surface **238** of the cover member **250** is disposed in a first plane when the trackpad **234** is in its first position and the entire top surface **238** of the cover member **250** is in a second plane substantially parallel to the first plane when the trackpad **234** is in its second position. The outer perimeter P (see FIG. **8**) of the cover member **250** is moved substantially an equal distance when the trackpad **234** is moved from its first position to its second position. Thus, when a user exerts a force, for example, on a right side of the top surface **238** of the trackpad **234**, the left side of the trackpad **234** will move the same or substantially the same distance as the right side. As described above, this can provide a user with a consistent tactile response when clicking on any location on the top surface **238** of the cover member **250** of the trackpad **234**.

When the user exerts an input force on the top surface **238** of the cover member **250**, the trackpad **234** will be moved from its first position to a second position, which will actuate the dome switch **240** and trigger an electronic signal within the computing device **100** as described above. Specifically, the dome switch **240** will move with the trackpad **234** such that it is compressed against the actuation member **244** (e.g., the set screw), which will trigger an electronic signal from the dome switch **240** to the sensor **256** and to the computing device **100**.

FIG. **13** is a bottom perspective view of an input device **330** according to another implementation. The input device **330** can be, for example, a touch (e.g., contact) sensitive device, such as, for example, an electrostatic device, a resistive device, a surface acoustic wave (SAW) device, a capacitive device, a pressure sensitive device, a a surface capacitive device, a projected capacitive touch (PCT) device, and/or so forth as with above-described implementations.

The input device **330** includes a housing **332**, a touchpad assembly **334** and support members **336**. In this implementation, the housing **332** is an integral component of a computing device **300**, shown in FIG. **14**. The computing device **300** can be configured the same as or similar to the computing device **100** described above. The computing device **300** includes a base portion **304** and a display portion **302**. The

base portion **304** can include, among other components, the housing **332**, the trackpad **334** and a keyboard portion **380**. As shown in FIG. **13**, the housing **332** can define multiple openings **382** for the keys of the keyboard portion **380**. The display portion **302** of the computing device **300** includes a display **320** that can be, for example, a liquid crystal display (LCD), a light emitting diode (LED) display, or other type of display device.

The trackpad **334** can be configured the same as or similar to (e.g., include the same components) and can perform the same as or similar functions as the trackpad **134** and the trackpad **234** described above. For example, the trackpad **334** can include a cover member **350** (shown in FIG. **14**), first and second adhesive sheets (not shown), a sensor (e.g., a printed circuit board) **354**, a dome switch (not shown), and a base member **358**. The cover member **350** can be formed with, for example, an electrostatic glass material. The cover member **350** can include a top surface **338** (shown in FIG. **14**) configured to receive inputs (e.g., a touch or click) by a user. The sensor **354** can be activated when a user enters an input on the top surface **338** of the cover member **350** and can communicate electronic signals within the computing device **300**. The sensor **354** can be, for example, a flame-retardant class-4 (FR4) printed circuit board.

The first and second adhesive sheets can each be, for example, a pressure sensitive adhesive (PSA). The first adhesive sheet can be adhered to a bottom surface (not shown) of the cover member **350** and used to adhesively couple the sensor **354** thereto. A cable (not shown) can be coupled to a connector **361** (e.g., a ZIF connector) disposed on a bottom surface **355** of the sensor **354**. The cable can be, for example, a flat flex cable (FFC) or a flexible printed circuit (FPC).

The second adhesive sheet can be adhered to a top surface (not shown) of the base member **358** such that openings (not shown) defined in the second adhesive sheet align with corresponding openings **364** and **368** defined in the base member **358**. The second adhesive sheet can be used to couple the base member **358** to the bottom surface **355** of the sensor **354**. The dome switch can also be adhesively coupled to the bottom surface **355** of the sensor **354** such that the dome switch can extend through an opening (not shown) of the second adhesive sheet and an opening (not shown) defined in the base member **358**.

The base member **358** includes four legs **370** that can be used to support and couple the trackpad **334** to the housing **332**. Although four legs **370** are shown, it should be understood that a different number of legs can alternatively be used. The base member **358** also includes two alignment pins **346** disposed on or coupled to two of the legs **370**. As with above-described implementations, the alignment pins **346** can be used to align and slidably couple the trackpad **334** to the housing **332**.

The dome switch can be electrically coupled to the sensor **354** such that when the dome switch is actuated, the dome switch can communicate an electronic signal to the sensor **354**. The dome switch can include electronic components commonly used in such switches that can electrically communicate with the sensor **354**. The dome switch can include a flexible or compressible portion that can be flexed or compressed when actuated. For example, the dome switch can be pressed against an actuation member (not shown) when a user applies an input force on the top surface of the cover member **350** to initiate a click function.

The input device **330** also includes an arm member **342** that can be coupled to the housing **332** and the actuation member (e.g., a set screw) can be coupled to the arm member **342**. As described above for input devices **130** and **230**, during actua-

11
12

tion of the input device **330** (e.g., a clicking function), the dome switch can be compressed against the actuation member to trigger an electronic signal within the computing device **300** via the sensor **354**.

The four support members **336** are each configured to support the trackpad **334** in a first position relative to the housing **332**. The support members **336** can be, for example, spring members. Although four support members **336** are included in this implementation, it should be understood that a different number of support members can alternatively be used.

The support members **336** include a first end portion **372** fixedly coupled to the housing **332** with, for example screws, or other mechanical fasteners, and a second end portion **374** that is free-floating and disposed beneath and contacting a bottom surface **359** of the base member **358**.

The support members **336** can have a first configuration in which the support members **336** bias and support the trackpad **334** in a first position relative to the housing **332** and can be moved (e.g., bend or flex) to a second configuration when the trackpad **334** is moved to a second position relative to the housing **332**. For example, when a user exerts an input force on the top surface **338** of the cover member **350** to initiate a clicking function, the trackpad **334** will be moved downward (e.g., in a vertical direction) to its second position and exert a force on the support members **336**. In other words, the second end portion **374** of the support members **336** can bend or flex relative to the first end portion **372** of the support members **336** when a force is exerted on the top surface **338** of the cover member **350**.

The trackpad **334** can be slidably coupled to the housing **332** with the alignment pins **346** on the base member **358** as described for input device **130** and input device **230**. The alignment pins **346** can be slidably received within bushings (not shown) coupled to the housing **332** or can be slidably received within openings or channels (not shown) defined in the housing **332**.

The slidable coupling of the trackpad **334** to the housing **332** together with the support members **336** allows the trackpad **334** to move from its first position to its second position such that the top surface **338** of the cover member **350** is moved from a first plane to a second plane that is substantially parallel to the first plane. As with above-described implementations, an outer perimeter of the support member **350** is moved a substantially equal distance (e.g., in a vertical direction) when the trackpad **334** is moved from its first position to its second position. Thus, a user can actuate a clicking function by exerting an input force at any location on the top surface **338** of the cover member **350** of the trackpad **334**.

The components of the input devices (e.g., **130**, **230**, and **330**) described herein can be formed with a variety of different materials such as plastic, metallic, glass, ceramic, etc. used for such components. For example, the cover member (e.g., **250**), base member (e.g., **258**), support members (e.g., **136**, **236**, **342**), the switch (e.g., **140**, **240**), and the arm member (e.g., **242**), can each be formed, at least in part, with an insulating material and/or conductive material such as a stainless steel material, for example, SUS301 or SUS304. The housing (e.g., **132**, **232**, **332**) can be formed with, for example, various materials, such as, an aluminum alloy (e.g., Al5052).

While certain features of the described implementations have been illustrated as described herein, many modifications, substitutions, changes and equivalents will now occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the scope of the implemen-

tations. It should be understood that they have been presented by way of example only, not limitation, and various changes in form and details may be made. Any portion of the apparatus and/or methods described herein may be combined in any combination, except mutually exclusive combinations. The implementations described herein can include various combinations and/or sub-combinations of the functions, components and/or features of the different implementations described.

What is claimed is:

1. An apparatus, comprising:
a housing including a bottom wall disposed in a first plane;
a trackpad including:
a cover member having a top surface configured to receive an input force, the top surface disposed in a second plane parallel to the first plane;
a base member parallel to and disposed below the cover member, the base member having a bottom surface;
a first side;
a second side opposite and parallel to the first side;
an arm member coupled to the housing at a first end and a second end;
an actuation member coupled to the arm member; and
a switch coupled to the cover member;
a first spring member coupled to the first side of the trackpad, the first spring member including a first end portion and a second end portion opposite the first end portion, the second end portion in contact with the bottom surface of the trackpad, the first spring member disposed and elongated in a third plane parallel to the first plane and the second plane; and
a second spring member coupled to the second side of the trackpad, the second spring member including a first end portion and a second end portion opposite the first end portion, the second end portion in contact with the bottom surface of the trackpad, the second spring member disposed and elongated in the third plane, the first spring member and the second spring member each being disposed at a non-zero distance from each other and collectively configured to bias the trackpad in the first position,
the trackpad being movable to a second position in which the top surface of the cover member is disposed in a fourth plane substantially parallel to the second plane when an input force is exerted on the top surface of the cover member,
the switch configured to trigger an electrical signal within a computer when the trackpad is moved to its second position, the movement of the trackpad to the second position pressing the switch against the actuation member.

2. The apparatus of claim **1**, wherein the top surface of the cover member is bounded by a first side edge opposite a second side edge and a third side edge opposite a fourth side edge, the first side edge, the second side edge, the third side edge and the fourth side edge each move an equal distance when the trackpad is moved from its first position to its second position.

3. The apparatus of claim **1**, wherein the first spring member and the second spring member each have a first configuration in which the first spring member and the second spring member support the trackpad in its first position, the first spring member and the second spring member each being separately movable to a second configuration when the trackpad is moved to its second position.

4. The apparatus of claim 1,

wherein the trackpad is slidably coupled to the housing and includes at least two pins configured to be slidably received within a corresponding at least two bushings coupled to the housing.

5. The apparatus of claim 3,

wherein the top surface of the cover member has an outer perimeter,

the first end portion of the first spring member and the first end portion of the second spring member each being disposed outside the outer perimeter of the top surface of the cover member, and

the second end portion of the first spring member and the second end portion of the second spring member each being configured to support the trackpad in its first position.

6. The apparatus of claim 1, wherein the top surface of the cover member has an outer perimeter that defines a surface area of the top surface of the cover member, the trackpad configured to be moved to its second position when an input force is exerted on the top surface of the trackpad within the surface area of the top surface of the trackpad.

7. An apparatus, comprising:

a housing;

a trackpad coupled to the housing, the trackpad including:

a cover member having a top surface configured to receive an input force and having an outer perimeter;

a base member parallel to and disposed below the cover member, the base member having a bottom surface;

a side, the side of the trackpad being perpendicular to the cover member and the base member;

a switch coupled to the cover member;

an arm member coupled to the housing at a first end and a second end; and

an actuation member coupled to the arm member; and

a support member coupled to the side of the trackpad, the support member including a first end portion and a second end portion opposite the first end portion, the support member elongated in a direction parallel to the base member, the second end portion in contact with the bottom surface of the trackpad, the first end portion coupled to the housing and disposed outside of the outer perimeter of the top surface of the cover member, the second end portion of the support member configured to support the trackpad in a first position relative to the housing, the trackpad being movable to a second position relative to the housing when an input force is exerted on the top surface of the cover member, and the switch configured to be actuated when the trackpad is moved to its second position pressing the switch against the actuation member.

8. The apparatus of claim 7, wherein the switch is coupled to the cover member such that the switch moves with the cover member when the trackpad is moved between its first position and its second position.

9. The apparatus of claim 7, wherein the top surface of the cover member is disposed in a first plane when the trackpad is in its first position, the top surface of the cover member being disposed in a second plane substantially parallel to the first plane when trackpad is in its second position.

10. The apparatus of claim 7, wherein the trackpad includes at least one alignment pin configured to be slidably received within a corresponding at least one bushing coupled to the housing.

11. The apparatus of claim 7, wherein the trackpad includes at least one alignment pin configured to be slidably received within a corresponding at least one opening defined by the housing.

12. The apparatus of claim 7, wherein the support member is a spring member.

13. The apparatus of claim 7, wherein the top surface of the cover member is bounded by a first side edge opposite a second side edge and a third side edge opposite a fourth side edge, the first side edge, the second side edge, the third side edge and the fourth side edge each move an equal distance when the trackpad is moved from its first position to its second position.

14. An apparatus, comprising:

a housing;

a trackpad coupled to the housing, the trackpad including:

a cover member having a top surface disposed in a first plane and configured to receive an input force, the cover member having an outer perimeter in the first plane, the outer perimeter defined by a first side edge of the cover member, a second side edge of the cover member, a third side edge of the cover member, and a fourth side edge of the cover member;

a switch being coupled to the cover member,

an arm member coupled to the housing at a first end and a second end,

an actuation member coupled to the arm member, and

a base member coupled to and disposed below the cover member in a second plane parallel to the first plane, the base member including:

at least two legs extending beyond the outer perimeter of the cover member, and

at least two pins, each leg including a respective pin, each pin configured to be slidably received within a corresponding opening included in the housing to allow slidable movement of the trackpad relative to the housing; and

at least two support members coupled to the trackpad, the at least two support members collectively configured to bias the trackpad in a first position in which the top surface of the cover member is disposed in the first plane, the trackpad being slidably movable in a substantially vertical direction relative to the housing to a second position in which the top surface of the cover member is disposed in a third plane substantially parallel to the first plane when an input force is exerted on the top surface of the trackpad, the switch configured to trigger an electrical signal within a computer when the trackpad is moved to the second position, the movement of the trackpad to the second position compressing the switch against the actuation member.

15. The apparatus of claim 14, wherein the switch is configured to move with the trackpad when the trackpad is moved between its first position and its second position, the switch configured to be actuated when the trackpad is moved to its second position.

16. The apparatus of claim 14, wherein the corresponding opening is a bushing coupled to the housing.

17. The apparatus of claim 14, wherein the first side edge is opposite to the second side edge and the third side edge is opposite to the fourth side edge, the first side edge, the second side edge, the third side edge and the fourth side edge each configured to move an equal distance when the trackpad is moved from its first position to its second position.

18. The apparatus of claim 14, wherein the at least two support members are at least two spring members, the at least

two spring members having a first configuration in which the at least two spring members collectively bias the trackpad in its first position.

19. The apparatus of claim **14**, wherein each of the at least two support members are elongated in a direction parallel to the base member, have a first end fixedly coupled to the housing and disposed outside of the outer perimeter of the cover member, and have a second end configured to support the trackpad in its first position.

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